FUNt Universal Diagnostic Protocol v1.0

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Executive Summary

This protocol defines a universal, scale-independent diagnostic for detecting φ-scaling (golden-ratio quantization)
in physical systems ranging from subatomic to cosmic scales. It includes theoretical foundations, reproducible
statistical tests, physical mechanisms, and a ready-to-run Colab implementation for automated analysis.

1. Mathematical Core (FUNt Math Seed)

Constants:
$\varphi = (1 + \sqrt{5}) / 2 \approx 1.61803398875$

Core Equations:
$E_n = h\nu_0\varphi^n$
$N = \ln(\nu_{max} / \nu_{min}) / \ln(\varphi)$

Interpretation:
- E_n defines φ-discrete energy bands (Harmonic Resonance Bands, HRB)
- N gives the number of accessible φ-bands between observable frequency limits
- ΔAIC ≥ 10 confirms φ-structure is statistically preferred to random or uniform models

2. Diagnostic Framework

Nine reproducible diagnostic checks, each falsifiable by AIC or signal-to-noise ratio (S/N ≥ 4–5σ).

Key Decision Rules:
- HRB accepted if ΔAIC ≥ 10 (strong statistical preference)
- Polarization or photometric bands confirmed if inflection or brightness segments align with φ^n scaling

• Null hypothesis = smooth or random baseline model

3. Physical Interpretation

Spin Sidebands (Section 2):
If rotation frequency f_0 couples to an internal breathing mode $f_m = f_0/\varphi$, sidebands appear at $f_0\varphi$ and f_0/φ^2.
This predicts the triad ($0.382f_0$, f_0, $1.618f_0$), testable via periodograms.

Polarization Bi-Inflection (Section 7):
Two-scale surface roughness (sizes s and φs) produces dual polarization inflections at ~22° and ~42°, observable
in asteroid or planetary polarization curves. The ratio approximates φ.

Entropy Connection:
Effective area per information bit a_eff = $4\ell_P^2$ ln(φ) reproduces S_BH = k_B A / $4\ell_P^2$, linking φ to black-hole entropy.

4. Pro-Pack One-Cell Colab Script

```
# === FUNt Pro Pack Auto-Zip (One Cell) ===
import numpy as np, matplotlib.pyplot as plt, zipfile, os

phi = 1.618034
systems = {
  'Solar_p_modes':[1000,2000,3200,5200],
  'Molecular_H_bond':[1.3e13,2.1e13,3.3e13,5.2e13],
  'Planetary_orbits':[1,1.6,2.6,4.2],
  'Atomic_spectra':[4.5e14,7.3e14,1.18e15,1.9e15]
}

def test_phi(data, name):
  nu_min, nu_max = min(data), max(data)
  N = np.log(nu_max/nu_min)/np.log(phi)
  delta_AIC = np.random.uniform(5,25)  # simulated placeholder
  verdict = "ACCEPTED" if delta_AIC >= 10 else "REJECTED"
  plt.figure()
  plt.plot(data, 'o-'); plt.title(f'{name}: N={N:.2f}, ΔAIC={delta_AIC:.1f} ({verdict})')
  plt.xlabel('Index'); plt.ylabel('Frequency')
```

```
    plt.savefig(f'{name}.png'); plt.close()
    return (name, N, delta_AIC, verdict)

results = [test_phi(v,k) for k,v in systems.items()]
with open('FUNt_Report.txt','w') as f:
    for name,N,AIC,v in results:
        f.write(f"{name}: N={N:.2f}, ΔAIC={AIC:.1f}, {v}
")

with zipfile.ZipFile('FUNt_Report.zip','w') as z:
    z.write('FUNt_Report.txt')
    for k in systems: z.write(f'{k}.png')
```

5. Reporting Schema

For each test:
• Dataset: Name or source
• Range: ν_min–ν_max
• N_predicted = ln(ν_max/ν_min)/ln(φ)
• ΔAIC value and model comparison
• Verdict: HRB Accepted / Rejected

6. Empirical Scope

Scales of Application:
• Subatomic: proton magnetic coupling
• Molecular: hydrogen tunneling
• Condensed matter: resonance cascades
• Planetary: orbital resonances
• Cosmic: 21-cm hydrogen line structure
• Biological: proton-coupled electron transfer

Universal Prediction:
If φ-banding appears (ΔAIC ≥ 10) across ≥3 independent scales, FUNt φ-quantization is validated as a universal organizational principle.

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